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**UNITED STATES INTERNATIONAL UNIVERSITY – AFRICA (USIU)**

**ASSIGNMENT I**

**SUMMER SEMESTER 2022**

**APT2050: TELECOMMUNICATIONS & COMPUTER NETWORKS**

**INSTRUCTOR: DR. ABRAHAM NYETE**

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**NJERU OLIVER NJIRU 663565 DATE: 31/5/2022**

***INSTRUCTIONS:***  ANSWER **ALL** QUESTIONS

**Question One 15MARKS**

(a) Draw the TCP/IP protocol architecture model and list the different devices that operate at each layer as well their function in the network. **[10 Marks]**

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| --- | --- |
| Application Layer | This is where devices such as personal computers and phones are found that provide an interface between the applications and network. |
| Transport Layer (TCP) | This is where devices such as gateways are found that are responsible for translating protocols. |
| Network (IP) Layer | This is where routers are found that are responsible for routing data packets based on their IP addresses. |
| Data Link Layer | This is where devices such as bridges, switches and network interface cards are found that help in the flow and error control and network access processes. |
| Physical Layer | This is where hubs, cables, modems and repeaters are found that help in data modulation and encoding. |

(b). Consider the old landline telephone communication system whose transmission frequencies range between 0.3kHz and 3.4 kHz. Take the operational *SNR* to be 3162. Calculate the maximum channel transmission capacity *C* as predicted by the Shannon equation. Also, determine the required number of signal levels per symbol so as to achieve this data rate. **[5 Marks]**

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**Question Two 15Marks**

(a)A communication channel whose signal to noise ratio is 30dB is to transmit signals at a rate of 1500mbps. If the medium bandwidth is 100MHz, is this possible? Support your answer with mathematical proof. **[7 Marks]**

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b) Compare and contrast digital and analog transmission. **[4 Marks]**

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| --- | --- |
| **Digital transmission** | **Analog transmission** |
| **The signal transmitted is only digital** | **The signal transmitted can be both analog and digital** |
| **Signal transmitted is concerned with content** | **Signal transmitted disregards content** |
| **When a repeater is used, only the signal is amplified, not the noise** | **When the signal is amplified, the noise also gets amplified as well** |
| **Signals that are affected by attenuation are boosted using a repeater** | **Signals that are affected by attenuation are boosted using amplifiers** |

c) Derive and expression that relates the signal to noise ratio of the Shannon equation to the number of signal levels in the Nyquist equation. **[4 Marks]**

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